



US Army Corps Of Engineers

Hydrologic Engineering Center

First Quarter Activity Report

FY 2000

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Activity Report

Executive Summary

The brisk pace of activities at the end of FY 1999 carried through the first quarter of this year. The Water Control Data System (renamed Corps Water Management System) and NexGen software development projects remain our highest priority activities. We continued work on several significant field funded reimbursable projects, and are vigorously working on the new Dam Safety R&D program. The result is that we expect FY 2000 activities to continue at a vigorous pace, and funding to be at or slightly above that of recent past years. We altered our model maintenance subscription billing process and as a consequence, receipts are well ahead of that of past years. We presume that this also reflects satisfied customers. All-in-all, a healthy start for the new year.

The Corps Water Management System (CWMS) software modernization and integration project is now beginning the fourth year of an intensive six year, \$7.6 million development and deployment effort. CWMS is the Corps decision support Automated Information Systems (AIS) that supports the Corps water management mission. It embodies data acquisition, transformation, validation, and management; forecasting, simulation and decision support analysis; and information dissemination. CWMS modernization is a Corps AIS improvement project managed under the Corps Life Cycle Management of Information

Systems (LCMIS) process. The significant tasks for FY 2000 are to develop and install Test Version 2.0 in selected field offices, and continue development toward the final Test Version 3.0/CWMS Version 1.0 – by 30 June 2001. This quarter, Test Version 1.0 was reinstalled at the four selected field sites (Baltimore, Huntington, and Omaha Districts, Northwest Region - Portland), and this phase of testing closed out. The installation and testing of Version 1.0 pointed to the need to change development priorities, revise future testing plans, focus on software shortcomings, and initiate serious pre-deployment planning. An LCMIS Milestone II decision review was held on 30 November 1999. The Deputy Chief of Staff for Corporate Information and his staff were briefed by the Project Manager and Materiel Developer. The approval memorandum, authorizing Phase II development is expected to be signed on 12 January 2000. Plans were made for an Advisory Group meeting to be held in mid- February. This will be a critical meeting, initiating major focus on pre-deployment planning. Next quarter should see conclusion of Test Version 2.0 development and finalizing of the installation plan and schedule. Corps offices can follow progress on the project via the Web at (<http://cw71.cw-wc.usace.army.mil/cwcinfo/cwc.html>).

The NexGen software research and development project continues to roll out products. We

released a companion HEC-RAS Arc/Info GIS applications package that provides cross section geometry from digital terrain models, and enables automated inundation mapping. A bug fix and minor update for HEC-HMS (Version 1.1) was also released. We plan for summer releases of an update (Version 2.0) of HEC-HMS that will include a moisture accounting loss algorithm, and the first unsteady flow version of HEC-RAS (Version 3.0). We also expect to release additional GIS utilities in the summer time frame. Two NexGen software programs that are components of the Test Version 1.0 CWMS are a real-time reservoir operations model, and a flood impact analysis model. These programs will continue to be improved and will likely be released in stand-alone form late in FY 2000.

Activities in the risk-based analysis and flood frequency analysis areas continue at a steady pace. HEC participated in a National Academy of Sciences, National Research Council (NRC) panel review of the Corps use of risk-based analysis by attending meetings, making presentations, and exchanging information during the period December 1998 through December 1999. The NRC panel report is due in the spring/early summer. The re-study of flood frequency on the upper Mississippi River in light of the flood of 1993 is entering the final phase. A report documenting the flow frequency analysis methods and preliminary results is due shortly. We began

a case example application of extreme flood magnitude and frequency estimates as part of the new Dam Safety R&D.

The project to update the model geometry for the Mississippi Basin Model System (MBMS) for the upper Mississippi to reflect more recent mapping and to develop an inundation mapping component based on the new mapping was placed on hold for the first quarter. Map products from the contractors lagged, and funding for FY 2000 activities (integrating

the new geometry into the model, and calibrating the model) had not been received by the end of the quarter.

We concluded one and began another reimbursable project to assist in modeling the Sacramento and San Joaquin river basins for flood control operations. This is part of a comprehensive study by Sacramento District to review the flood damage reduction system for the Central Valley of California. Preliminary models were

completed in Phase I, and improved models are now under development for Phase II. The models (separate models for the Sacramento Valley and San Joaquin Valley) are: HEC-5 for flood control operations; HEC-FCLP, system flood control operation optimization; and HEC-FIA, flood economic/damage impact analysis model, and HEC-HMS (flood runoff model). Data compilation, and some of model development will later serve as the base for modernized CWMS implementation for these areas.

Darryl W. Davis, P.E.
Director

Hydrologic Engineering Research Program

Catchment Analysis System

Work Unit 32444

(research 1st/00 R00-001)

Extensive beta testing of HEC-HMS Version 2.0 revealed some errors and some desirable improvements. Most of the testing was for the new continuous soil moisture accounting routines, and extended optimization flexibility. Bug corrections were also made that increase program performance and stability. The new user's manual was reviewed by HEC staff and is being

updated. Extensive HELP screens were developed for every main screen of the program. HEC and field offices also reviewed the technical reference manual; the final version is now being revised/edited per review comments. Version 2.0 will be released in the spring. The Technical Reference Manual will be released as soon as it's completed, probably shortly after the HMS release.

Development of HMS Version 2.1 is well underway. Most of the engine work for new hypothetical storms and paired-data usage has been completed. The GUI for those capabilities will begin next quarter. Development continues on the Java graphics and GUI. The snow melt software continues to be developed and tested by CRREL.

River Analysis System

Work Unit 32443

(training 1st/00 R00-002)

This work unit will produce a uniform set of tools for use by hydraulic engineers in a workstation environment. The River Analysis System (HEC-RAS), Version 1.0 program was completed, the hydraulic reference and user's manuals were published, and the package started distribution in August 1995. The program is a Windows-based standard-step model that computes steady-flow profiles for subcritical, supercritical, or mixed flow regimes. During FY 1996, Version 1.1 and 1.2 were

released to provide error corrections and an added program capability. In FY 1997, in-line weirs and spillways, channel modifications, links to 3D geometric data, and numerous program enhancements were completed. The Federal Highway bridge model and scour analysis was added with FHWA funding, and Version 2.0, plus three reference documents were distributed. In FY 1998, the components of an unsteady flow program were developed and steady-flow Version 2.1 was developed and released. During

FY 1999, HEC-RAS Version 2.2 and new program documentation were completed and distributed. Development of the steady-flow capability continued through the FY and into the first quarter of FY 2000, when the steady-flow features were completed. The new program options will be included in the PROSPECT Advanced HEC-RAS course presented in January 2000. Development has shifted to adding an unsteady-flow capability under a new work unit.

Resolving Water Allocation and Use Conflicts

Work Unit 32976

(planning 1st/00 R00-003)

Under this work unit HEC develops and applies reservoir system optimization programs to assist in resolving water allocation and use conflicts that arise from changing conditions. The two primary programs are the Prescriptive Reservoir Model (HEC-PRM) and Flood Control Linear Program (HEC-FCLP).

For the past two years we have focused on the flood control linear program and have made significant strides towards making it a viable tool for both derivation of system operation rules and in optimal operation of forecasted events. We continue to push the operations research's state-of-the-art for flood analysis by

enabling more detailed representation of the reservoir system. Procedures to limit the foresight and means to better mimic overall system reservoir outflow and weir flow conditions are examples. An alpha version of the FCLP program is now an option in HEC's NexGen Reservoir System Simulation

(HEC-RSS) program. It is termed HEC-RSS/LP. In 1999, HEC-RSS/LP was applied to the Iowa and Des Moines river system and

is presently being used in the Phase II Sacramento District Comprehensive Study. We have prepared a draft user's manual

and are targeting the initial release of HEC-RSS/LP during the fourth quarter of this year.

Unsteady Modeling for River Analysis

Work Unit 33275 (training 1st/00 R00-004)

This work unit was initiated this FY to develop an unsteady-flow modeling capability and incorporate it in the HEC-RAS computer program. The goal is to develop and provide a complete set of unsteady-flow options to

complement the steady-flow options developed under the River Analysis work unit. During this year, a beta version and Version 3.0 release are expected. The Version 3 program will include the last set of steady-flow features

and an initial set of unsteady options. During the first quarter development and testing continued. A beta test version is expected during the second quarter, with a limited testing population.

Reservoir Analysis System

Work Unit 32602 (training 1st/00 R99-005)

The objective of this work unit is to develop a family of reservoir analysis tools to facilitate a broad range of investigations ranging from reconnaissance-level planning studies to detailed reservoir regulation plan investigations. These tools will complement the existing HEC-5 Simulation of Flood Control and Conservation Systems Program and the Prescriptive Reservoir Model, HEC-PRM. A requirements document for a new

reservoir model was completed in FY 1995. During FY 1996, a basic reservoir GUI was developed to create model data and run computer programs HEC-5 and HEC-PRM. In FY 1997, the focus shifted to develop a prototype reservoir model for the Corps Water Management System (CWMS). A software design was developed to support the CWMS goals and to provide a next generation system model. During FY 1998, a prototype

reservoir model was essentially completed and, during the first quarter of FY 1999, the prototype program was completed. Test Version 1.0 was completed and installed at the Corps' test sites as a component of the Corps Water Management System. During the first quarter of FY 2000, field testing and program updates continued. Design of the Version 2 features continued. Development will commence during the second quarter.

Integration of NexGen for Watershed Studies

Work Unit 33268 (planning 1st/00 R00-006)

Creation of procedures and capabilities to provide a fully integrated interface of HEC models for water resources planning and watershed management analysis studies are the objectives of this new work

unit. A watershed/ planning style Control and Visualization Interface (CAVI), tailored from the Corps Water Management System (CWMS) CAVI, will link the suite of models, data processing, and spatially referenced displays. The

CAVI will be designed this FY and a functioning prototype in the first quarter of FY 2001. The final product will streamline the analysis process while producing more consistent results and shared displays.

Terrain-Based H&H Modeling

Work Unit 32975 (research 1st/00 R00-007B)

Hydrology. The beta version of HEC-GeoHMS received extensive testing at HEC and in several field applications. Numerous updates and improvements to the software have been made both by HEC and through the Cooperative

Research and Development Agreement (CRADA) with the Environmental Systems Research Institute (ESRI). The user's manual was partially completed and will be finished for release with the software next quarter.

Research continues with the University of Texas' Center for Research in Water Resources (CRWR) where water resource objects are being investigated.

Terrain-Based H&H Modeling

Work Unit 32975

(training 1st/00 R00-007A)

Hydraulics. With the development of HEC-GeoRAS, the Hydrologic Engineering Center has linked ARC/INFO data development and display capabilities to HEC-RAS for performing hydraulic analysis. HEC-GeoRAS facilitates model development by allowing a hydraulic engineer with little GIS training to develop geometric data

for import in HEC-RAS and view exported water surface profile results. HEC-GeoRAS Version 1.0 was released during the third quarter of FY 1999, including user's manual documentation. During the remainder of the FY 1999 and the first quarter of 2000, an ARC/View version of GeoRAS was developed, including the

capability to estimate roughness coefficients for import into, and visual display of velocities exported from HEC-RAS. The program will be demonstrated and applied in the Advanced HEC-RAS and GIS classes during the second quarter. Development and documentation will be completed early in FY 2000.

Urban Hydrology Methods

Work Unit 32875

(research 1st/00 R00-008A)

Hydrology. A report on the use of rating curves to represent hydraulic structures in HEC-1 and HEC-HMS was completed. Several different types of hydraulic structures were considered for representative use in HMS. Guidance charts were produced to aid in the selection of

the appropriate method to represent a hydraulic structure in a hydrologic model. The charts consider slope, backwater, data quality, and required accuracy. An example is now being developed to test and illustrate the capability for improved hydrologic routing through a hydraulic

structure with backwater conditions. A separate program will be used to solve the routing through a structure represented by a family of rating curves in conjunction with a downstream tailwater rating curve.

Urban Hydrology Methods

Work Unit 32875

(training 1st/00 R00-008B)

Hydraulics. This work unit will develop modeling features required for many urban studies. The requirements for unsteady flow applications in the urban environment have been reviewed and defined in conjunction with the review of a UNET application

for the Sacramento District. Some required hydraulic features will be incorporated with the development of unsteady flow capability in HEC-RAS. During the third quarter of FY 1999, plans were developed to use the hydraulics library, developed for

HEC-RAS, to develop hydraulic ratings for water control structures. Work continued on the hydraulics library through FY 1999 and into the first quarter of 2000.

Flood Damage Analysis

Work Unit 32876

(planning 1st/00 R00-009)

Under this work unit, HEC continues to develop software for more efficient flood damage and plan formulation and evaluation computations. The research efforts are coordinated with the Risk Analysis Work Unit 32896 and Geographic Information System Work Unit 33173, Flood Damage Analysis Using GIS Technology. Work for FY 2000

will concentrate on development of the new HEC-FDA Version 2.0 package, a significant advance over the earlier versions of HEC-FDA. The highly integrated package will feature the familiar HEC-FDA risk-based analysis capabilities for flood damage reduction studies, plus event/continuous record analysis and user interactive analysis and

displays using spatially referenced data. An updated version of HEC-FDA, Version 1.1, that fixed minor bugs was released during the first quarter of FY 2000. The conversion of HEC-FDA to a JAVA user interface with the spatially referenced display similar to other NexGen programs was also initiated.

Flood Hydrology and Hydraulics of Wetlands

Work Unit 33291

(research 1st/00 R00-010)

This is a new work unit with minimal start-up funding. Wetlands impacts on floods have been analyzed for local areas, but little has been accomplished on a regional basis, e.g., on the Great Mississippi Flood of '93.

Analytical methods and guidance are needed to characterize and evaluate regional impacts of wetlands. This work will characterize the hydrologic and hydraulic impacts of wetlands on individual areas and on regional

floods. Analytical methods for determining the hydrologic and hydraulic impacts of wetlands (or loss thereof) on a regional basis will be developed, tested, and documented. Work will begin later this FY.

Analysis of Ground-Surface Water Interaction

Work Unit 32703

(research 1st/00 R99-022)

This work unit was temporarily suspended this FY because of limited funding.

Risk Assessment Research Program**Hydrologic Risk & Uncertainty & Environmental Restoration Performance**

Work Unit 33214

(planning 1st/00 R00-031)

This work unit targets development of procedures and documents for hydrologic engineering analysis associated with riverine environmental restoration studies. The analysis of low- and high-flow regimes affecting the design, maintenance, and operation of the project over its life is quantified along with associated uncertainty considerations of the project.

Emphasis is on defining and developing methods for hydrologic variables, and defining key uncertainty components that are important to riverine restoration investigations. The HEC work is part of associated efforts of the Environmental Lab (CEERD-EV) and the Institute for Water Resources (CEWRC-IWR) who are responsible for the biological and policy aspects of

the R & D work, respectively. HEC's first quarter activities concentrated on developing a draft of a Hydrologic/Hydraulics Guide Manual for Riverine Restoration Studies. HEC conducted extensive phone interviews with most Corps offices to discuss their experiences in developing the hydrology and hydraulics portions of constructed riverine wetland studies.

Residual Risk of FDR Projects

Work Unit 33289

(planning 1st/00 R00-032)

The objective of the new Residual Risk research is to create procedures and capabilities to define and communicate the residual flood risk for various project types (levees, channels, detention storage, nonstructural measures) and study settings (population at risk, egress,

damage potential). This will include information on the flood characteristics resulting from impaired-operation for a range of events; development of project performance risk indicators and information; and assessment of capacity exceedance event impacts on the physical setting,

general population, and responsible response agencies. The procedures are to be performed within existing Corps engineering requirements and include such components as risk-based analysis approaches. No funds were available for this work unit during the first quarter.

Geographic Information System Research Program

Flood Damage Analysis Using GIS Technology

Work Unit 33173

(planning 1st/00 R00-040)

The use of spatially referenced data for analysis and displays are the basis of the R&D effort. It focuses on development of software to conduct flood damage analyses in a more integrated manner, reduce field survey time and effort, and generate easier to interpret output and displays. The approaches will be merged into the HEC-FDA Version 2.0 package. The design and implementation is also closely

coordinated with flood impact analysis software being developed under CWMS activities. During the quarter, we concentrated on development of alternative GIS methods for structure inventories, damage analysis, and displays. Included were: 1) structure inventories derived from grid cell representations of land use, census blocks, and parcels; 2) computations using aerial

photograph images, digital elevations, and flood inundations; and 3) spatial output generated by HEC-GeoRAS. A prototype of the structure inventory tied to the HEC-FDA database and damage calculations for event flood inundation elevations, depths, and velocities was completed.

Risk Analysis for Dam Safety Research Program

Assessing Hydrologic Loading Uncertainty

Work Unit 33257

(research 1st/00 R99-051)

Work began on the analysis of rainfall statistics for the American River basin, California, test application area. The analysis was performed on the entire west

slope of the Sierra Nevada Mountains as the region pertinent to American River basin. A report on those rainfall statistics was completed. The next step will be

to extrapolate the rainfall statistics and input them to a runoff model using a Monte Carlo simulation.

Estimating Probability of Extreme Floods

Work Unit 33258

(research 1st/00 R99-052)

A review of the state-of-the-art of estimating the probability of extreme floods was made. This work unit will concentrate, at least initially, on assessing the probability of extreme rainfall as

described in the work unit above, and on estimating the magnitude and frequency of extreme floods from paleoflood data. A report on the use of paleoflood data for rare-flood analysis was also

drafted. A paleoflood investigation of the American River tributary to Folsom Dam will also be undertaken in this work unit.

Corps Water Management System

The significant tasks for FY 2000 are to develop and install Test Version 2.0 in selected field offices, and continue development toward the final Test Version 3.0/CWMS Version 1.0 – by 30 June 2001. This quarter, Test Version 1.0 was reinstalled at the four selected field sites (Baltimore, Huntington, and Omaha Districts, Northwest Region - Portland), and this phase of testing closed out. The installation and testing of Version 1.0 pointed to the need to change development priorities, revise future testing plans, focus on software shortcomings, and initiate serious pre-deployment planning. An LCMIS Milestone II decision review was held on 30 November 1999. The Deputy Chief of Staff for Corporate Information and his staff were briefed by the PM and MD. The approval memorandum, authorizing Phase II development is expected to be signed on 12 January 2000. Plans were made for an Advisory Group meeting to be held in mid- February. This will be a critical meeting, initiating major focus on pre-deployment planning. Next quarter should see conclusion of Test Version 2.0 development and finalizing of the installation plan and schedule. Material about this project is posted on the Web at: <http://cw71.cw-wc.usace.army.mil/cwcinfo/cwc.html>.
(executive 1st/00)

Data Capture

(tech asst 1st/00 AEM W00-050)

The data capture was tested at each of the four field sites. The design of active messaging for data capture components was developed. The data capture

software manages data socket byte streams of GOES or AFOS(SHEF) data. The streams are obtained from a StreamSender server process

anywhere in the network and will be fed into the Corps Water Management System (CWMS), where it is decoded and posted to the Oracle database.

Data Decoding, Transformation and Validation

(tech asst 1st/00 AEM W00-051)

Work was focused on the second part of the transformation and validation steps. The inclusion of real-time mathematical and table lookup transformation of data as it is received and posted to the Oracle database was

implemented in Version 1.0. This “on-the-fly” processing of data can reduce the extra resources of some of the processing that would normally take place after the data has been initially stored in the database. The second part is the

targeting of complex transforms and validations that will be done only to those data that have been received in a specified time interval.

Data Base System

(tech asst 1st/00 DJB W00-052)

Work this quarter was expended on the development of the Pro*C DBI to Oracle interface. This will replace the JDBC interface and allow significant data loading performance improvements. Data base system testing experience and field test site feedback indicated a need for the data base component to be improved to perform at a peak rate of 3500 values per minute for storage of data delivered through the data acquisition component. The fielded technology using a Java

data base interface server, Java data base connectivity protocol, and Oracle stored procedures has apparently reached its performance limits at about 200 to 2000 values per minute, dependent on amount of data resident in storage tables. Recommended improvements to achieve the requirement of 3500 values per minute, include modification of the Java data base interface, the implementation of an Oracle Pro*C application to perform data base I/O and

business rules checking, and the use of JNI protocol to integrate these elements. This technology eliminates the need to do business rules checking in stored procedures which is a significant time cost in the current technology. Because of funding issues, implementation of this proposal was moved to FY 2000. Therefore, the improved performance capability target was moved into Version 2.0 for completion by 28 February 2000.

Data Dissemination(tech asst 1st/00 CWF W00-053)

Data Dissemination work for this quarter of FY1999 was centered on the development of sample web documents that directly interface into the Oracle database. They include display of

data as plots, tables, gif images and PDF files. Each of the field test sites are implementing local interfaces to their existing Web servers. There is continuing concern regarding the impending

implementation of firewalls at the CEAP Internet interface and at each local district/division office.

Data Archiving(tech asst 1st/00 DJB W00-054)

Archiving is required to provide data for mission performance accountability, to enable Corps offices to disseminate and/or exchange data, and to provide a consistent data file system suitable as legal documentation. Automated means will be provided for periodic archiving and as needed purging of

information from the CWMS database. Means will also be provided for automated retrieval from the data archive and placement into the CWMS database or standard dissemination files. Data archiving was included in the requirements and software design process being overseen by the Data Base

SDT Team. Data archiving, was not included in the field Test 1.0 software suite.

Work on data archiving has been limited to the automated management of log and model files that grow within the CWMS file system structure.

Flow Forecasting and Forecast Evaluation(research 1st/00 W00-055)

Work began on the needs identified for improved computation status information and data visualization in Version 2.0. Testing of the MFP program, which reads gridded precipitation

directly from the database as needed, was successfully concluded. Also, testing of the gageInterp program with scripts that extract gage precipitation from the database via cron jobs

was successful. Flow and stage forecasting via HEC-HMS and HEC-RAS are continuing to function as intended.

Reservoir System Simulation(training 4th/99 W00-056)

Starting in FY 1997, requirements for real-time reservoir simulation were completed, a planning budget was developed, and priorities were set to fit the initial budget. Then a conceptual design document was developed to define program operation and a prototype plan was developed for initial program development. During FY 1998, the prototype reservoir program and pilot

project data were completed. During the second quarter of FY 1999, Test Version 1.0 installation started with the Baltimore and Huntington Districts, and installation in the remaining two offices was completed during the third quarter. Model testing continues with those offices. Version 1.1 modifications were completed during the fourth quarter and program field testing

began early in FY 2000. Testing continued through the first quarter of FY2000, yielding several program deficiencies that were corrected with the release of Version 1.2. Design of Version 2 was nearly completed during the first quarter and development will commence during the second quarter.

River Hydraulics and Stage Forecasting(training 1st/00 W00-057)

The hydraulic component work was initiated in FY 1997. During the first half year, program requirements for river-stage

forecasting were developed, reviewed, and completed; and a planning budget was developed. During the second half, a

conceptual design document was developed and plans for a prototype program were completed. In FY 1998 a real-

time interface for HEC-RAS for the CWMS was completed and integrated into the software system. During FY 1999 the interface update was completed to meet Version 2.2 capability. The updated software was

included in the CWMS installation to Baltimore, Huntington, and Omaha Districts, plus the North West Region - Portland. Development of the unsteady-flow modeling for the CWMS was initiated in the fourth quarter FY

1999. Development continued during the first quarter of FY 2000, with the expectation that the CWMS interface will be ready when Version 3 HEC-RAS is ready for release.

Flow Impact Analysis

(planning 1st/00 W00-058)

The Flow Impact Analysis (HEC-FIA) computer program development continues with minor debugging and testing performed.

The procedures for incorporating the project benefit accomplishments component of the program with links to the HEC-RSS holdout analysis output were completed. HEC is also

working with the RS/GIS Center at CECRL on their implementation of the GIS flood impact analysis capabilities for water control applications. The program is being designed and tested under the general direction of the water control flood impact analysis design team consisting of Corps field offices, CECRL, and HEC

representatives. The beta version is being applied for test installation sites. The goal is to have the HEC-FIA Version 1.0 program ready for release and fully integrated with the CWMS system by the second quarter of FY 2000.

System Integration, Implementation, and Management

(tech asst 1st/00 AFP W00-059)

The activities this quarter included updating of quarterly progress charts, and their integration with the required LCMIS quarterly report format.

The priority work task has been the improvement of the client-server architecture when used in a wide area network (WAN). Tests were conducted to help establish the impacts on client-server performance. Based on the information obtained from these tests code changes will be accomplished next quarter to provide acceptable Version 2.0 capabilities.

Weekly developer status meetings are held to coordinate the critical items being developed for Field Test Version 2.0. The set of JCL scripts that control the starting of each CWMS component have been revised. The newly developed procedures log the critical steps to provide better tracking of their execution. Checks are included to prevent continuation when files or other processes are not running. Scripts were also refined to be more general across sites. Scripts now use consistent system environment variables to define system specific information.

The testing of internal scripting languages has been completed. It is expected that the Jpython scripting language will be used to control all components of the CWMS. Of particular interest will be the scripting of user-defined plots and tables.

The implementation of the CWMS message and alarm system is continuing. When complete it will be part of Version 2.0. This will make the system become an "active" system indicating to the user when data feeds and other system components have failed.

Application of GIS and Image Technology

(research 1st/00 W99-060)

Testing was performed on the GIS programs for snowmelt forecasting and their integration with the HEC-HMS modeling environment. This snowmelt forecasting system mirrors the

gridded ModClark procedures for rainfall runoff forecasting. The system consists of algorithms for preparing gridded input data, i.e., temperature and snow water equivalent, a distributed snow

process model (DSPM), and export visualization routines for CorpsView. Work began on the Version 2.0 implementation plans. CorpsView was implemented at NWD.

Control and Visualization Interface(tech asst 1st/00 WJC W00-061)

As indicated above, a major effort has been initiated to improve the performance of the CAVI client-server architecture in the WAN. The initial testing in a LAN, which had delay times of one to three milli-seconds, did not surface unacceptable performance impacts of the WAN network which has response times of 100

to 300 milli-seconds. Some revisions have been made to the CAVI modules in their layout. Renewed focus has been placed on the design and functioning of the Data Acquisition and Data Visualization CAVI modules. Specific functionality for each of these modules will be incorporated in the Version 2.0

release. Design of additional modules dealing with Administration and System Alarms has been initiated. The development of CAVI User Documentation is currently being accomplished by a separate task order.

Field Application Assistance(tech asst 1st/00 CWF W00-062)

During this quarter, support for the four field test sites (NAB, LRH, NOW, NWD) continued. The support needed to implement this suite of software has been

considerably greater than first anticipated. Lessons learned from this experience will be very helpful for understanding how features of the system can be

simplified in the next Field Test version.

Numerical Model Maintenance and Support

Numerical Model Maintenance for the family of HEC software consists of bug fixes and minor updates, hardware/software platform support, documentation updates and hot-line technical support. Corps offices that subscribe for these fee services receive full support including: new software releases; interim updates and bug fixes; user's manuals and supporting documentation; short-duration technical consulting; and hot-line technical assistance via E-mail, fax, and telephone. Corps offices that do not subscribe are limited to the same courtesy afforded to other federal agencies: referral to HEC Web page and the National Technical Information Service (NTIS) for major software release versions; HEC Web page and NTIS for documents; and response to official correspondence regarding potential program errors and bugs. Subscription fees for FY 2000 total about \$550,000. The primary software within each numerical model area together with the number of requests for assistance over the previous one year period, are shown below. A discussion of significant activities in each of the modeling areas follows the table. Mailings for FY 2000 subscriptions took place in August. The fee structure was slightly revised and simplified, and the IFH category consolidated with Surface Water Hydrology. A stream lined billing and notification system was implemented to improve funds receipts over that which occurred in FY 2000. Receipts to date indicate improved payment rate, and we presume, satisfied customers. (executive 1st/00)

<i>Numerical Model Area</i>	<i>Primary Software</i>	<i>Calls for Assistance Last Four Quarters</i>				
		^{2nd} Quarter FY 99	^{3rd} Quarter FY 99	^{4th} Quarter FY 99	^{1st} Quarter FY 00	Totals
Surface Water Hydrology	HEC-1, HMR52, HEC-HMS, HEC-IFH	66	58	50	41	215
River Hydraulics	HEC-RAS, HEC-2, UNET, HEC-6, HEC-GeoRAS	38	43	40	30	151
Flood Damage & Impact Analysis	HEC-FDA, HEC-FIA, HEC-SIA	47	33	38	18	136
Risk and Statistical Methods	HEC-FFA, STATS	17	06	10	05	38
Reservoir/Optimization Systems	HEC-5, HEC-5Q, HEC-PRM, HEC-RSS	04	10	21	23	58
Data Management Systems	HEC-DSS/DSPLAY	23	45	35	30	133
TOTALS		195	195	194	147	731

Surface Water Hydrology

(research 1st/00 M00-001)

Maintenance this quarter continued to concentrate on user support for HEC-HMS Version 1.1 both in application assistance and bug correction. Several changes

were made to the manner in which variables are 'fixed' to constant values in the optimization process. Other support was provided for HEC-1,

HMR52, urban H&H models; and the groundwater model MODFLOW.

River Hydraulics and Stage Forecasting

(training 1st/00 M00-002)

Application assistance and one-stop phone assistance continues for HEC-RAS, UNET, HEC-6, and HEC-2. During the fourth quarter of FY 1999, a contract was issued

to assist in developing an updated version of UNET. During the first quarter of FY 2000, the contract work was nearly complete. Testing and documentation will

start during the second quarter and a UNET Version 4.0 is expected this FY.

Flood Damage and Impact Analysis(planning 1st/00 M00-003)

Consultations with Corps offices using risk-based analysis methods remain at a high rate. Enhancements and corrections to

the HEC-FDA program and its database processing procedures were made during the quarter. HEC-FDA Version 1.1 was

released during the quarter. It represented fixes to the Version 1.0 program.

Risk and Statistical Methods(research 1st/00 M00-004)

Program support was provided for program FFA and STATS and

their application in flood frequency investigations.

Reservoir Optimization Systems(training 1st/00 M00-005)

General maintenance and field support activities for the HEC-5 family of programs continues. Program updates and

modifications for complex system operation goals continued. Program assistance continues on a request basis. An HEC-5

Version 8.1 is being prepared for release in FY 2000.

Data Management Systems(tech asst 1st/00 M00-006)

Support activities for this quarter were primarily centered on telephone support and routine maintenance for the data management tools such as SHFDSS, DSSSHF, DWINDO, DSSUTL, DSSPLAY, REPGEN, and DSSMATH. Further effort

was made to test 'Y2K' issues. An updated version of the SHEFDSS program has been made available for Corps wide distribution. This program and others may be downloaded from the HEC Web site (www.hec.usace.army.mil). Some

extensions to DSSMATH were made that allow periods of accumulated precipitation that are reported in NCDC (National Climatic Data Center) data sets to be converted to missing, or be uniformly distributed over the accumulation period.

Technical Assistance and Special Projects

Technical Assistance Projects are reimbursable projects performed for HQUSACE, Corps district and division offices, research laboratories, other federal agencies, and local governments. The scope of each project is negotiated on a case-by-case basis, including the full range from technical advisory services, review and oversight of studies by others, to performance of all aspects of investigations. Arrangements are made such that contracting associated with technical assistance projects is credited to the sponsoring office's contracting-out percentage. New projects begun this quarter include: next phase of upper Mississippi flood frequency study (MVR); stream gauging program updates (CECW-EH); assistance in reservoir modeling (SAM); field testing of CWMS in Mississippi Valley (MVD); advisory panel services to FEMA and National Institution for Building Sciences (NIBS) on the HAZUS flood model project (NIBS); initiation of guidance document development for H&H aspects of environmental restoration/wetlands studies (CECW-EH); and several meeting attendance's, project reviews, and short consultations (SPL, SWD, SPK). (executive 1st/00)

HQUSACE

CECW

Hydrology Committee

(research 1st/00 P99-009)

The Corps Hydrology Committee met at HEC on 07-08 December 1999. The principal subjects reviewed were: the Sacramento District comprehensive study of the Sacramento and San Joaquin River basins, frequency analysis of the Upper Mississippi River System, and new capabilities of the HEC-GeoHMS and -GeoRAS software for GIS support of hydrologic and hydraulic modeling.

FPMS Support

(training 1st/00 P00-011)

Headquarters Floodplain Management provided funds for HEC program support. No activity occurred during the first quarter.

Streamgauging Software System

(tech asst 1st/00 P00-004)

The gauge Oracle/Web application software was successfully used in the previous Corps-wide data update cycle. Work is now deferred pending compilation of comments and improvement needs resulting from field experience. Work began in first quarter on a new set of reports for the gauge applet system. Improvements and corrections to the gage applet are scheduled in the second quarter of FY 2000

MISSISSIPPI VALLEY DIVISION

Rock Island

Regulated Flow Frequency Assistance

(research 1st/00 P99-026)

A report entitled 'Regulated Frequency Curve and Pool Elevation Frequency Estimates for the Des Moines and Iowa River Basins, Iowa' was completed and furnished to the Rock Island District. The 1993 flood had an unusually long duration and large volume, although the

accompanying peak inflows to Saylorville and Coralville reservoirs were not the peak annual events of record. The great volume and duration of the flood filled reservoirs and caused the significant flooding observed in the study area. Consequently, estimating the likely future occurrence of these volumes rather than flood peaks was the most important consideration in estimating the regulated frequency curves.

Upper Mississippi River Flood Profile Study

(research 1st/00 P00-003)

Assistance was provided to several districts performing frequency analyses in the study area. Topics included: frequency analysis of mixed populations of snow and rain floods, determination of regulation and basin development has significant impacts on historical flood series, determination of unregulated floods where substantial regulation has occurred, and analysis of the need for additional data in some locations. HEC led a technical review meeting of Corps study participants and also provided technical input to the Public Involvement citizens group.

HEC-FIA Modeling

(planning 1st/00 P99-018)

HEC assisted the Rock Island District with development of an HEC-FIA model for the Iowa and Des Moines River basins and extending it downstream on the Mississippi River to Quincy, Illinois. The model, which included 13 impact areas, was completed and presented to the District during the quarter.

Reservoir Modeling

(training 1st/00 P99-019)

Rock Island District has requested development of rule-based reservoir simulation as a component of the Corps Water Management System (CWMS). During the third quarter of FY 1999, HEC conducted a test and developed a progress report on the concept of using multiple-linear programming to "solve" the release decision based on reservoir-release rules. During the fourth quarter, HEC developed a reservoir operations plan to meet District requirements along with CWMS requirements. Development work is holding until the design for the Test Version 2.0 program is completed.

ENGINEER RESEARCH AND DEVELOPMENT CENTER

Cold Regions Research Laboratory

Oahe Frequency Study

(research 1st/00 P99-027)

Assistance is being provided to CRREL in a study of ice impacts on Missouri River flow frequencies below Oahe Dam.

GREAT LAKES REGIONAL HQ

Detroit

Support for Plan 77A(tech asst 1st/00 P00-005)

HEC provided support and continued development regarding the Coordinated Great Lakes Regulation and Routing Model for Detroit District. The model unifies and enhances several piecemeal programs employed by the Corps, Environment Canada, and NOAA's Great Lakes Environmental Research Lab. The work focused on testing the implementations of the Lake Superior regulation and routing through Lakes Michigan, Huron, St. Clair, and Erie; evaluating proposed changes to their methodology; documentation; and initiating development of the Lake Ontario/St. Lawrence River module. HEC will continue these efforts throughout the fiscal year, conducting a training workshop in late July.

Nashville

HEC-HMS on the Cumberland River(research 1st/00 P99-035)

This project will develop a gridded HEC-HMS model for the Cumberland River basin. Most of the work was delayed until after the first quarter because of other priorities. Basic GIS data were collected and datums and projections for the DEM and GIS data were discussed. Future work will define subbasins using GeoHMS, establish the HEC-HMS model, investigate use of HMS soil moisture accounting to replace the antecedent precipitation infiltration method in Nashville's version of HEC-1, and begin using radar rainfall in runoff calibration.

SOUTH PACIFIC DIVISION

Los Angeles

Analysis of Tres Rios(training 1st/00 P00-010)

During 13-14 December 1999, HEC staff attended a coordination meeting concerning potential applications of GIS technology to better present and analyze modeling results for the Tres Rios environmental study.

Sacramento

Technical Review of American River Project(research 1st/00 P00-008)

Reports were reviewed and need for additional information identified.

Tooele Groundwater(research 1st/00 P00-009)

The Tooele MODFLOW groundwater model was recalibrated with new data about the geology and water levels. An additional layer was constructed in the model to better delineate the location

of newly discovered bedrock. Previously, the bedrock was thought to be deeper and not contained in layer 1; however, recent field measurements show that it intrudes into layer 1. Also, additional field data on water levels and pumping rates were available. The recalibration was successful and a report on the new model and results was drafted.

Phase II Sacramento and San Joaquin River Basins Comprehensive Study

(planning 1st/00 P00-001&002)

HEC is assisting the Sacramento District with its Sacramento and San Joaquin River Basins Phase II Comprehensive Study. HEC's Phase I effort was completed during the second quarter of FY 1999. It developed basic level flood damage and reservoir system models for the Sacramento and San Joaquin watersheds. Now in Phase II, we are further refining those models and developing comprehensive HEC-HMS models for both watersheds. The \$1.4m seven-month effort involves HEC staff, contractor participation, and close coordination with District and State of California DWR personnel. The HEC part of the Phase II study is scheduled for completion in April 2000.

Data Collection and Processing. An extensive data assembly effort was completed during the first quarter. The event data are used for hydrologic, reservoir, and flood damage model calibration studies. The four-month data collection process involved over 50 agencies. It yielded flow, stage, rainfall, temperature, and snow records for the March 1995 and January 1997 events and for the period-of-record. The resulting 8000+ time-series data sets were assembled, reviewed and screened for acceptability, and cleaned-up for subsequent modeling use. Period-of-record data were retained in the raw form because of the time constraint and lack of immediate need for the data in the HEC modeling effort. The Corps Cold Region/Remote Sensing Laboratory is assisting HEC in a snow analysis – providing a distributed snowmelt water equivalent time distribution for the two events under study.

HEC-HMS Modeling. The HEC-HMS modeling of the Sacramento and San Joaquin watersheds represents the major part of the HEC Phase II effort. Basin delineation and the HEC-HMS model construction were performed using Geo-HMS with USGS 30-meter digital elevation model data. Subbasin delineation criteria were based on drainage area size, streamgage and reservoir locations, and stream topology. The modified-Clark approach was applied using a two-kilometer grid over the watersheds. Rain and melted snow distributions for the events were calculated for each grid. During the second quarter, unit graph and loss rate parameter estimations from optimization analyses at gaged locations and subsequently derived regression equations to estimate the parameters to ungaged locations will be performed. The models will then be calibrated to the March 1995 and January 1997 events. Eighteen HEC staff members are involved in the HEC-HMS model development exercise. Five Sacramento District personnel participated in a three-day workshop for model development of the San Joaquin Watershed.

Reservoir System Modeling. The reservoir system analysis includes both the simulation modeling using the HEC-5 and optimization analysis of water allocation of the systems using the new HEC-RSS/LP, the Reservoir System Simulation-Flood Control Linear Program, with a Windows users interface. The Phase II effort further refines the Phase I model for the Sacramento and San Joaquin systems. The models will ultimately use the HEC-HMS generated hydrographs for inflows to the reservoirs and local contributing flows for the two events. The HEC-5 analysis will derive a reservoir system simulation set of models for the watershed. The Phase I HEC Flood Control Linear Program (FCLP) models will be converted from the batch program to HEC-RSS/LP. The program will be used to study the reservoir system effects and operation rules.

Flood Impact Analysis. HEC-Flood Impact Analysis (HEC-FIA) models for the Phase I level Sacramento and San Joaquin basins were completed during the third quarter of FY 1999. During the first quarter of this fiscal year, the Phase II models are being further calibrated to the 1995 and 1997 observed event data. Information for the 87 impact area is being significantly upgraded.

This includes the stage-urban damage, stage-number of structures, and stage-population functions, as well as, crop distribution patterns. The HEC-FIA models will enable planning and real-time event assessments of flood impact of the Sacramento and San Joaquin systems.

NORTH ATLANTIC DIVISION

Baltimore

Anacostia River Watershed Feasibility Study

(planning 1st/00 P99-023)

HEC is assisting the Baltimore District on its Anacostia River flood damage reduction feasibility study. The study is investigating the feasibility of levee raising and constructing wetlands between the levees. During FY 1999, HEC worked with the district to develop the structure inventory and overall study approach. A preliminary HEC-FDA model was constructed and tested. HEC continues to work with district staff to refine the model. In the first quarter, we conducted a technical review of the district's procedures for estimating the exceedance probability functions for the two gaged locations within the study area. Comments were provided to the district. The exceedance probability functions are sensitive in that the District and Prince George's County have significant differences in the estimates and that the results affect levee sizing evaluations, FEMA levee certification, and existing county regulatory policies. HEC has proposed a workshop next quarter to see if general concurrence on the exceedance probability functions can be reached.

SOUTH ATLANTIC DIVISION

Mobile

Reservoir Simulation Modeling HEC-5

(training 1st/00 P00-006)

The Panama Canal Authority (PCA) requested additional HEC-5 modeling assistance for their canal capacity study. HEC developed daily time-step versions of the monthly HEC-5 reservoir system models. The model data and documentation were provided to PCA staff during a tech-transfer meeting in December 1999, which completed this added task.

RCC Meeting

(training 1st/00 P00-007)

During 1-2 December 1999, HEC staff attended a SWD coordination meeting to provide an overview of the Corps Water Management System development and the new Reservoir System Simulation program.

TECHNOLOGY TRANSFER

There were no PROSPECT courses during the first quarter. The FY 2000 schedule is shown in Table 1.

Other Training Activities

One HEC-RAS workshop was scheduled for January 2000, as shown in Table 2.

Table 1. HEC FY 2000 PROSPECT TRAINING SCHEDULE

Course Title	Date	Length (weeks)	Number Students
Advanced HEC-RAS	24 - 28 Jan 2000	1	
GIS - Hydrologic Engr	13 - 17 Mar 2000	1	
Flood Hydrology with HEC-HMS	08 - 12 May 2000	1	
Reservoir System Analysis	19 - 23 Jun 2000	1	
Water and Watershed	17 - 21 Jul 2000	1	
River & Wetland Restoration	11 - 15 Sep 2000	1	
TOTALS:		6	

Table 2. HEC FY 2000 WORKSHOPS

Title	Sponsor	Date	Length (days)	No. of Students
HEC-RAS (Bismarck, ND)	CEMVP	4 - 7 Jan 2000	3.5	
		TOTALS:		